

Aurora Portable Generator Operation Manual

Models AGI6500DE & AGI6500SDE



INTRODUCTION

Customer satisfaction is very important to us. If at anytime you have any questions about this manual or require further help we encourage you to contact us by visiting our website at www.AuroraGenerators.com and using our LIVE CHAT, sending an e-mail to Support@AuroraGenerators.com or call us Toll Free at 1-877-510-6807

This manual is updated on a regular basis. Insure you have the latest version by downloading it from Aurora Generators website.

Read all instructions and warnings before using this product.

This manual provides important information on proper operation & maintenance. Every effort has been made to ensure the accuracy of this manual. These instructions are not meant to cover every possible condition and situation that may occur. We reserve the right to change this product and instructions at any time without prior-notice. The information contained within this document is updated regularly on our website.

If there are any safety concerns, do not operate this product.

Do not return this product to the retailer - Contact customer service for service or assistance.

If you experience a problem, have questions or need parts for this product, call customer service at 1-877-510-6807 A copy of your sales receipt maybe required.

This generator is intended for residential consumer use only.

This generator is intended for residential emergency standby use only. Air cooled generators cannot be run full time and are not manufactured for commercial use.

SAFETY INFORMATION

(For safe operation please follow the instructions strictly)

Risk of fire and explosion

- Never use gasoline in a diesel engine or fire and explosion may result.
- Always handle fuel outdoors
- Identify the correct fuel type and model before refueling.
- Always wipe off any spilled fuel and oil before using your generator.
- Keep generator away from any flammable products and at least 3 feet clearance on every side.
- Never use it in an enclosure
- Refuel in a well-ventilated area with the engine stopped.
- Do not fill the fuel tank above the upper limit line. Diesel fuel may expand during operation.
- Empty the fuel tank before storing or transporting this generator.
- Before transporting, turn the fuel valve to the “OFF” position.

Acid warning

- Be careful when using any battery
- Batteries will exhaust hydrogen while charging.
- Only charge a battery in a well ventilated place
- Keep away from open flame, heat or spark
- Avoid spilled battery acid. If contact with skin is made, wash immediately with water.

Carbon monoxide warning

Carbon monoxide poisoning occurs after the inhalation of carbon monoxide gas. Carbon monoxide (CO) is a product of combustion of organic matter under conditions of restricted oxygen supply, which prevents complete oxidation to carbon dioxide (CO₂).

Carbon monoxide is colorless, odorless, tasteless, and non-irritating, making it difficult for people to detect.

- Do not run the generator indoors, in confined spaces or in unventilated areas.
- The carbon monoxide gas produced by gas and diesel engines can kill you.

Electrical Shock Warning

- Electricity can kill you.
- Installation should be preformed by a certified electrician. Improper installation can result in electrical shock and death.
- Follow all electrical safety code for your area. Consult an electrical safety inspector or electrician.
- Do NOT hook up any generator to a buildings electrical system without the proper use and installation of a transfer switch installed by a qualified electrician.
- Keep the generator dry.
- To reduce the risk of electrical shock do not use it in the rain or snow. Your generator should be protected from the elements
- Do not allow children or non-qualified persons to operate this generator.

Operator Responsibility

- Know how to stop the generator quickly in case of emergency
- Understand the proper operation and maintenance procedure before using it
- Be sure anyone using the generator receive proper instruction
- Keep away from children and animals

Connections to a building electrical system

Connections for standby power to a building's electrical system must be made by a qualified electrician. The connection must isolate the generator power from utility power, and must comply with all applicable laws and electrical codes. A CSA or UL approved transfer switch is recommended. Improper connections to a building's electrical system can allow electrical current from the generator to back feed into the utility lines. Such back feed may electrocute utility company workers or others who contact the lines during a power outage. When utility power is restored, the generator may explode, burn, or cause fires in the building's electrical system. You are required to check local regulations for proper registration, use and procedures for generators. The ground terminal can be used to earth the generator or bond the frame of the generator to the frame of a vehicle, but only if it is required by local law or electrical code. Before using the ground terminal consult a qualified electrician or electrical inspector for regulations in your area.

Generator ground circuits

Bonding the neutral wire to ground is required on some construction sites. Industrial Generators provide neutral bonding. Some models are neutral bonded which allows the industrial generator to pass Occupational Safety and Health Administration job site inspections. Portable generators have a system ground that connects generator frame

components to the ground terminals in the AC output receptacles. The system ground may or may not be connected to the AC neutral wire. This is called "neutral bonding". Local regulations, codes or laws may require that the ground system be connected to the AC neutral wire depending on its use. Most of our products have a "neutral bonded" grounds.

AC Applications

Before connecting an appliance or power cord to the generator: Make sure that it is in good working order. Faulty appliances or power cords can create a potential for electrical shock. If an appliance begins to operate abnormally, becomes sluggish or stops suddenly, turn it off immediately. Disconnect the appliance, and determine whether the problem is the appliance, or if the rated load capacity of the generator has been exceeded. Make sure that the electrical rating of the tool or appliance does not exceed that of the generator. Never exceed the maximum power rating of the generator. Power levels between rated and maximum may be used for no more than a few minutes. Substantial overloading will open the circuit breaker. Exceeding the time limit for maximum power operation or slightly overloading the generator may not switch the circuit breaker OFF, but will shorten the service life of the generator. Do not exceed the current limit specified for any one receptacle. If an overloaded circuit causes the AC circuit breaker to switch OFF, reduce the electrical load on the circuit, wait a few minutes and then reset the circuit breaker. An overloaded DC circuit, excessive current draw by the battery, or a wiring problem will trip the DC circuit protector. It is either a push button that extends out or is a physical fuse that will have to be replaced. If this happens, wait a few minutes before pushing in the circuit protector to resume operation. If the circuit protector continues to switch off or blow fuses, discontinue charging and check your load. Empty batteries, or low batteries may overload the circuit.

DC Operation

The DC terminals on the front of the generator panel may ONLY be used for charging 12 volt automotive-type batteries. Do not start a vehicle while the battery charging cables are connected and the generator is running. The vehicle or the generator may be damaged. It is not a smart charger and can over charge batteries. Caution should be used when charging any battery.

Aurora Generators use a charge controller / voltage regulator to maintain its down 12 volt battery for electric starting.

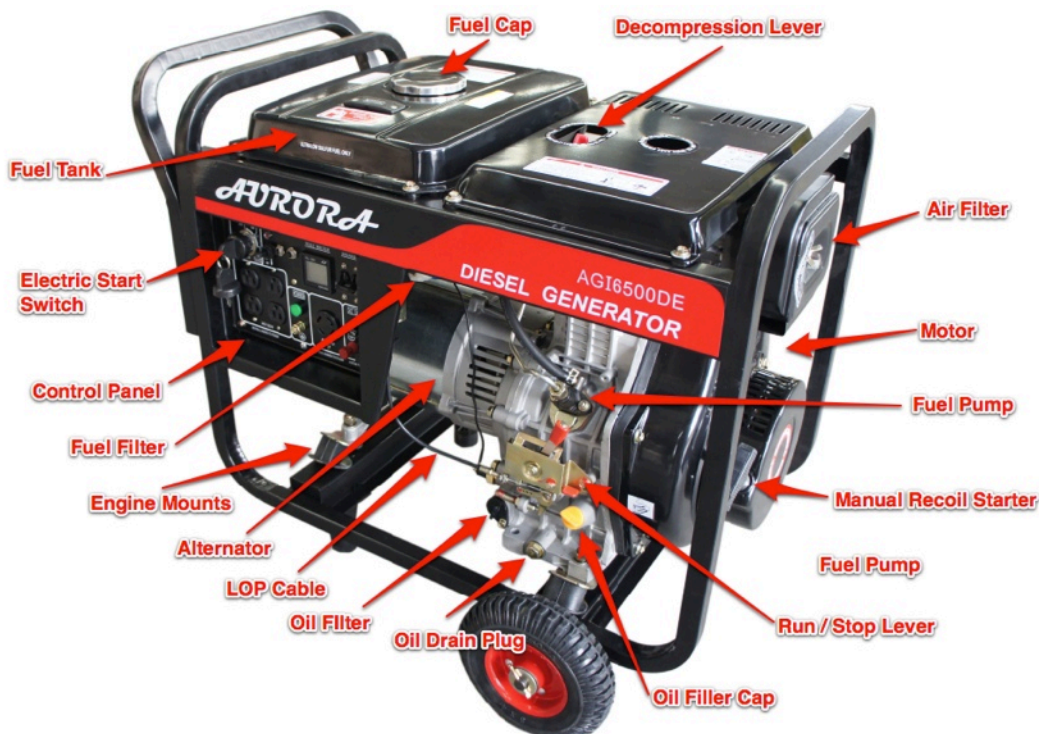
GENERATOR OVERVIEW

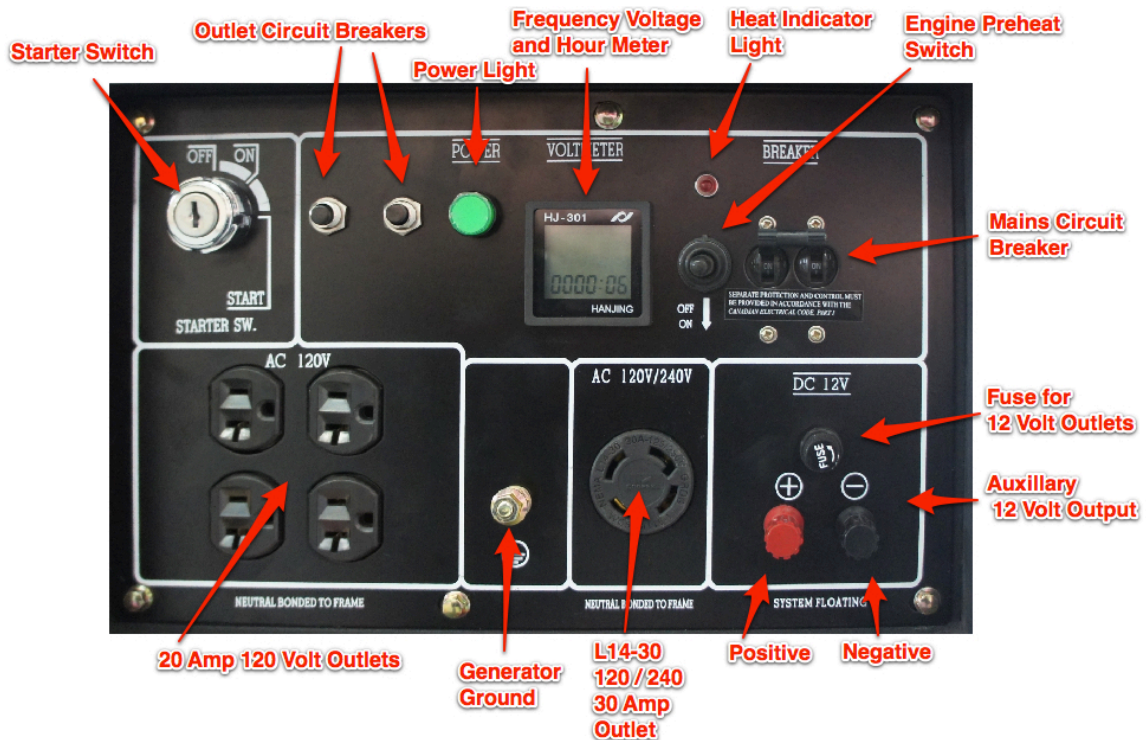
The main difference between the Aurora open frame generator and enclosed silenced type is the noise it produces. Both models use the same engine and alternator with some minor differences.

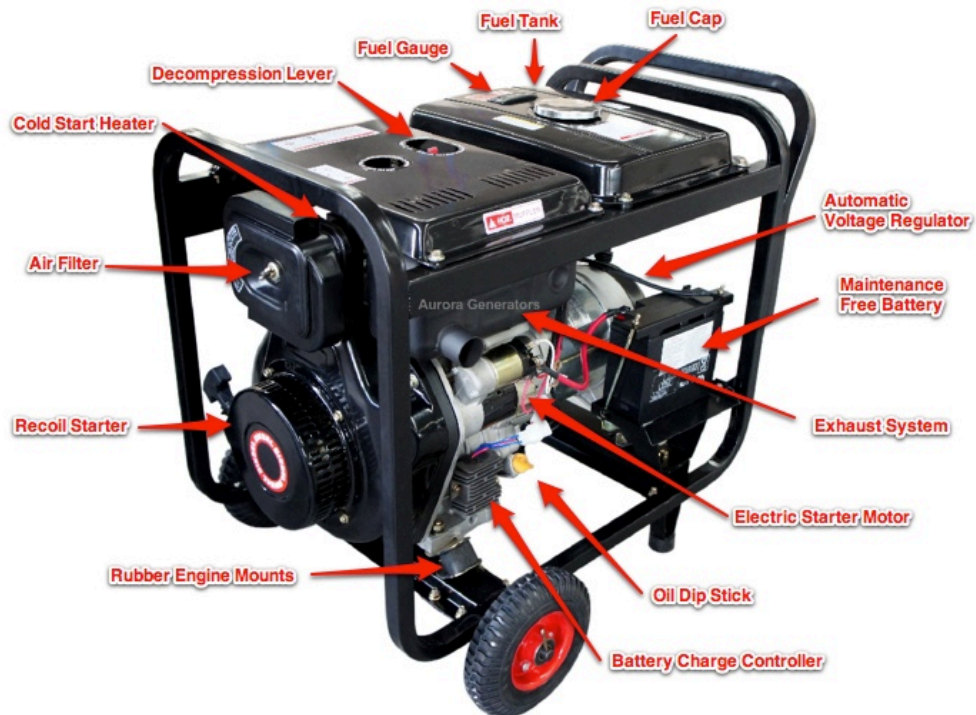
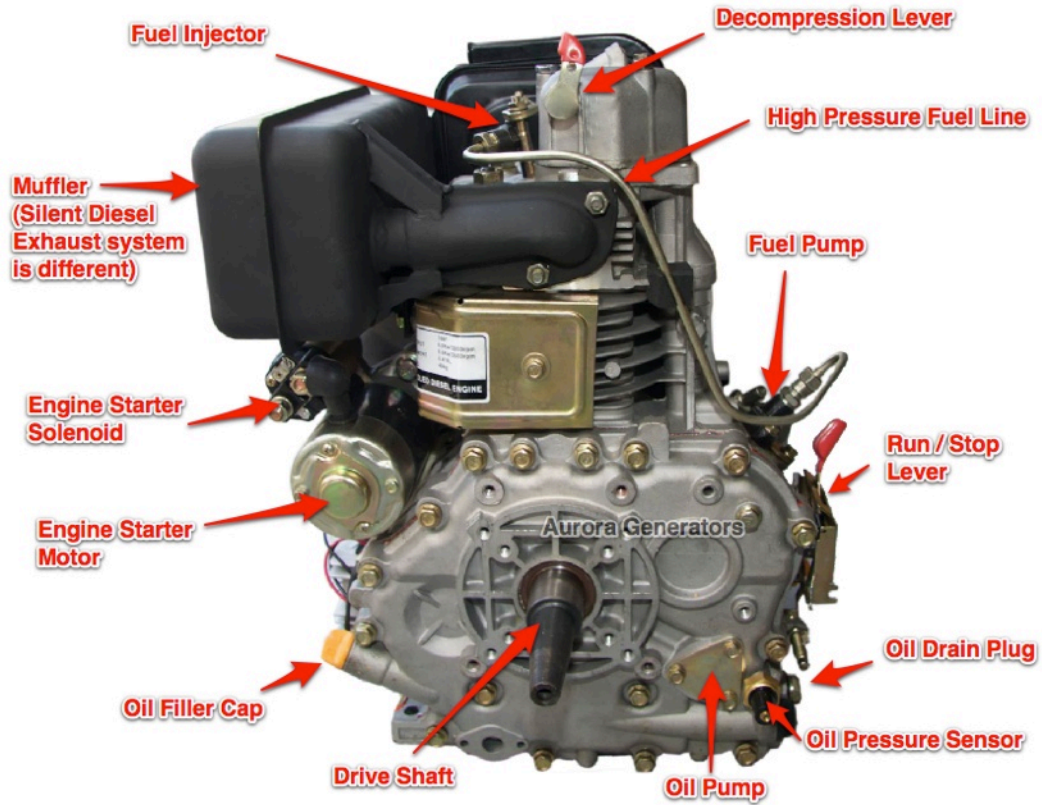
The enclosed silent diesel generator uses two much larger mufflers and a separate diesel oxidation catalyst (also known as a catalytic converter) The enclosed diesel generator does not use a manual recoil starter. In place of the manual recoil starter is a larger flywheel with fins used to force air through the enclosure, around the engine and exhaust system to keep it running at normal temperatures. The enclosed silent type generator runs much quieter and comes with a remote control to start and stop it.

Common Features

- EPA Approved 11 HP Diesel 186F Type Single Cylinder Engine 3600 RPM
- FCC Approved Remote Control Transmitter (Silent Diesel Only)
- ETL Certified to CSA Standard 22.2 No 100
- Self Excited 2 Pole Singe Phase Alternator
- 12 volt, 120 and 240 volt output
- User Adjustable Automatic Voltage Regulator
- Electric Start (silent version includes remote control start)
- Battery Included in both models
- Automatic Low Oil Shut Down
- Digital Hour, Voltage and Frequency Meter







Technical Specifications	
Generator Model	AGI6500DE & AGI6500SDE
Certifications	2010 / 2011 EPA ETL Approved to CSA 22.2 No.100
Engine Model	Aurora 186F
Engine Type	Air cooled single cylinder, 4 stroke, direct injection diesel.
Cooling System	Forced air cooled
Engine Speed	3600 RPM (60 Hz) 3000 RPM (50 Hz)
Engine Displacement	418 cc
Engine Bore	86 x 72
Engine Power	11 HP
Engine Lube Oil	Synthetic 15W40 for diesel motors only.
Oil Lube Capacity	1.65 L
Engine Lube Oil Pump	Forced
Engine Run Time	12 Hours / 2.9 Gallons under 75% load
Cold Start Heater	Installed on air intake
Decompression Valve	Installed on engine
Fuel Type	Diesel Ultra Low Sulfur Automotive Fuel Only.
Max Height Above Sea Level	1000 Meters / 3280 feet
Generator Type	Self Excited two poll single phase
Voltage Regulator	User adjustable automatic voltage regulator
Generator Insulation	Class F
Power Factor	1
Rated Frequency	60 Hz.
Rated Output	120 Volts @ 41.6 amps 240 Volts @ 28.8 amps

PRINCIPLES OF OPERATION

Fuel System

The Generator Fuel System provides filtered and pressurized diesel fuel to the diesel engine. It consists of a fuel tank with removable fuel fill strainer, fuel lines, fuel filter, fuel injection pump, and a fuel injector.

The diesel fuel is stored in a fuel tank. The tank features a plastic mesh strainer in the fill neck opening and a fuel tank drain valve. The fuel tank supplies fuel via a flexible tube to the fuel filter. The fuel filter removes impurities and water from the diesel fuel before it reaches the diesel engine. The fuel filter is made up of a clear bowl and filter head with a throw-away paper filter. The fuel filter also includes a fuel shutoff valve and some version include bleed screws for removing air trapped in the fuel system. Another flexible tube connects the fuel filter and the fuel injection pump (part of the diesel engine).

With the engine cranking or running, the fuel flow is controlled by a mechanical governor (part of the diesel engine) and the fuel injection pump. The fuel injection pump pressurizes the fuel and transfers it to the fuel injector. Fuel is sprayed by the injector into the engine combustion chamber where it is mixed with air and ignited. ([This video explains how it works](#)) The fuel that is not burned by the engine is returned to the generator set fuel tank via an excess fuel return line on the fuel injector. The returning fuel is used to lubricate the injector and keep it cool. Any derbies in the fuel system may cause the fuel injector to stick open or not close completely. This dripping of fuel will result in poor combustion and engine operation.

The diesel engine is shutdown by the operator depressing the engine STOP lever which places the fuel injection pump control rack in the no fuel position. Stop the fuel and you stop the engine. For models that can be shut off by an electric switch, an electric solenoid pulls a cable that releases the same RUN/STOP lever. The drawbacks are that you have to reset this RUN/STOP lever back to the run position the next time you want to use the generator.

Alternatively some models use an electric fuel switch to stop the fuel from reaching the fuel pump. The switch is an electric magnet that pulls open a spring loaded plunger with rubber stopper at the end of it. When open, the engine can run normally. When closed it starves it of fuel causing it to shut down.

Low oil pressure detected or the engine starter switch turned to the off position can trigger either one of these devices to shut down the engine starving it of fuel.

Some fuels can damage the rubber fuel stopper inside the electric fuel switch causing it to stick and not open. Overheating or intermittent electrical connection may cause the electric magnet release or fail resulting in a engine that will not start or is starved of enough fuel that under load it fails to run correctly. This electric fuel switch is only

required for automatic engine starting and stopping. Removing the plunger inside will defeat it and let you continue using your engine in the event of this component failure. If this component fails immediate replacement is recommended in order for low oil pressure auto safety shut down the engine and prevent further damage.

Engine Air Intake and Exhaust System

The Engine Air Intake and Exhaust System provides filtered air to the diesel engine and an outlet for exhaust gas produced by air/diesel fuel combustion. The system consists of an air intake filter, air intake manifold, exhaust manifold, and muffler system.

The air intake cleaner features a foam pre-filter and a disposable paper filter element. Air is drawn through the pre-filter and the filter element. Airborne dirt is trapped in the pre-filter and air intake filter element. Filtered air passes through the filter, air intake manifold, and open intake valve into the engine combustion chamber where it mixes with pressurized diesel fuel and is combusted.

Immediately following combustion, hot gases are forced out of the combustion chamber (through the open exhaust valve), and into the exhaust manifold. The exhaust manifold passes the gases into the muffler which deadens the sound created by the combustion process. The gases then pass through diesel oxidation catalysts and the muffler system. A muffler system can get very hot and personnel may occur if users inadvertently touch the muffler while the diesel engine is running or before it has cooled down.

Engine Speed Control

Diesel engine speed is maintained by the speed control system which includes the mechanical governor, governor lever, RUN lever, and STOP lever. The system is designed to maintain engine speed under load at a constant rate of between 3570 and 3630 rpm (no load speed of 3750 rpm).

The governor is the flyweight-type, with the weights mounted on a gear driven by the engine camshaft gear. The force of the flyweights is transferred through a thrust sleeve and collar to the governor lever which is balanced against the tension of the governor spring. The spring is stretched between the governor lever and the engine RUN lever. When the engine speed drops below the governed speed, the resulting decrease in governor flyweight / camshaft rotation places tension on the governor spring. The tension repositions the fuel injection pump rack and increases the stroke of the plunger in the fuel injection pump allowing more fuel to flow to the pump delivery valve. The increase in fuel flow causes the diesel engine to speed up. As the diesel engine recovers to the governed speed, the governor flyweight / camshaft rotation stabilizes and the tension on the governor spring relaxes. This changes the position of the fuel injection pump rack and shortens the stroke of the plunger allowing less fuel to flow to the fuel injectors maintaining the engine speed at 3600.

The governor control mechanism features two operator controlled levers. The diesel engine RUN lever places tension on a spring attached to the governor lever. The tension places the governor lever in a position to allow fuel flow to the fuel injector for diesel engine start up and to allow the diesel engine to continue running after start up.

The diesel engine shutdown or STOP lever is operated by either depressing the red STOP lever or by the low oil pressure shutdown system. When depressed, the lever trips the RUN lever releasing the tension on the governor spring which places the governor lever in a no fuel or stop position. This action shuts off fuel flow to the fuel injector stopping the combustion process and shutting down the diesel engine

Engine Electrical Starting System

The diesel engine electrical starting system can be used to start the diesel engine whenever there is a 12 VDC power source connected. Aurora generators have a battery included with the generator that may already be connected. When the generator is running, it recharges the battery. Electrical Starting will be required when starting the diesel engine in extremely cold weather or as a backup to the manual starting system found on the open frame type generators. The electrical system also provides a means for warming diesel engine intake air which also helps to start the engine in cold weather. The system consists a momentary contact switch located on the generator electrical panel.

Starting the engine with the starter motor is possible when the operator places the start switch in the START position, power is applied through the switch to the starter solenoid. This energizes the coil in solenoid which pulls in the solenoid's plunger and pushes the starter drive pinion attached to the plunger toward the engine flywheel. This movement engages the starter pinion drive with the ring gear teeth on the diesel engine flywheel. As the solenoid plunger pulls in, the power available at solenoid pin S is applied via a jumper to the starter motor which rotates the starter pinion drive (part of the starter motor) and turns over the flywheel engaged with the pinion drive to start the diesel engine. Immediately after the diesel engine starts, the generator set operator releases the START switch. This opens the solenoid-starter circuit causing the solenoid plunger to release the starter pinion drive disengaging it from the engine flywheel ring gear. At the same time, the starter motor is de-energized. The starter pinion will return to its normal position as the starter motor slows to a stop.

When your generator is running, the battery is automatically kept charged. A charge regulator is mounted on the side of the engine and gets its power from the generator. A dead battery or very low charged battery can overload and damage the built in charger. Never use a low charged or dead battery.

Engine Pre-Heating

Preheat Circuit. The diesel engine features one 12-VDC resistance-type heater located in the engine air intake piping between the intake manifold and the air cleaner. The

heater warms the air intake piping and manifold in order to warm up the intake air during attempted cold weather starts. To use it, toggle the momentary switch located on the front panel. Press down on it and hold it for up to 20 seconds. It will power the glow plug to heat it up. Release it and start your generator normally.

De Compression Lever

The de-compression lever is often used to aid in cold starting or when starting using the manual recoil starter. Pressing the decompression lever causes the exhaust valve to be held open and prevents compression during the up stroke. Eliminating the compression cycle helps the operator create enough inertia and engine speed that when compression is restored starting should be much easier.

Generator Voltage Regulation

The generator voltage regulation and output supply system senses the load being drawn at the load terminals and adjusts the alternator output accordingly. The system also monitors and adjusts generator set performance and provides power to the electrical terminals and receptacles.

The system consists of the AC alternator, voltage regulator, ON-OFF load circuit breaker, output load terminals, AC Volt Meter, Hour Counter, Frequency HERTZ meter and voltage adjustment potentiometer.

The generator set output voltage is controlled by the voltage regulator. The voltage regulator continuously senses the alternator output voltage. The voltage regulator reacts to voltage variations by manipulating the alternator field current to maintain the output voltage. The field current controlled by the voltage regulator is supplied by the alternator excitation windings. The voltage regulator performs this function using three interactive sub circuits: power input, load sensing, and DC output. The power input circuit draws current from the AC generator exciter windings through the positive (+) field brushes at A1 pin 3. The load sensing circuit monitors the current being drawn by the load at A1 pin E1. As demand increases, the DC output circuit draws current from the power input circuit, rectifies it to direct current, and reapplies it to the AC alternator (G2) field via A1 pins F+ and F-.

Starting the diesel engine automatically field flashes the AC alternator (G2) with residual magnetism stored in the rotor. The residual magnetism induces voltage in the power excitation windings at AC alternator (G2) pins + and 2. As the diesel engine speed begins to increase toward its governed no load speed of 3750 rpm, the induced voltage in the power excitation windings increases. The voltage regulator (A1) power input circuit receives current from the power excitation windings via the positive (+) field brushes at A1 pin 3. Whenever the voltage in the load sensing circuit matches the set point, the current entering the voltage regulator (A1) at pin 3 is allowed to pass through the power input circuit. Whenever the voltage entering the sensing circuit is lower than the set point (indicating a load increase) the DC output circuit reacts by drawing current

from the power input circuit. This current is rectified to DC and reapplied via A1 pins F+ and F- to the AC alternator rotor brushes at G2 pins + and -. The application of direct current to the rotor increases the field magnetism between the AC alternator stator and rotor which in turn, increases the current measured across the alternator power windings. The current measured at both the excitation and power windings will increase until the voltage entering the voltage regulator (A1) load sensing circuit matches the set point at which point, the alternator output stabilizes and the A1 DC output circuit stops drawing current from the power input circuit.

The voltage regulator set point can be changed by adjusting the VOLTAGE ADJ. potentiometer.

The generator set performance can be monitored by observing the AC VOLTS meter and Hertz Frequency Meter. The VOLTS AC meter (M2) measures the voltage across the power windings of the AC alternator and displays the value in VAC from 0 to 300. The HERTZ frequency meter measures frequency across the power windings in Hz from 45 to 65. The mains circuit breaker protects the VOLTS AC and HERTZ frequency meters from a potential over current condition.

Low Oil Pressure Protection

The low oil pressure protection system shuts down the diesel engine in the event of low oil pressure in order to protect the engine from further damage. The system consists of a low oil pressure switch located in the engine block above the oil strainer, a low oil pressure solenoid mounted in the control panel, and a cable connecting the low oil pressure solenoid to the diesel engine STOP lever. The enclosed diesel generator does not use a pressure solenoid, a electric fuel switch is use instead and is mounted on the fuel pump.

Under normal operating conditions the low oil pressure sensor switch OPENS at 15 PSI. If a malfunction occurs in the lubrication system causing the oil pressure to drop below the low oil pressure set point, the low oil pressure switch closes and completes a circuit causing either the engine stop solenoid to release the engine STOP lever or if equipped, closes shut the fuel valve located on the fuel pump. When this occurs the low oil pressure light will illuminate on the generator control panel.

STARTING THE GENERATOR

Before you begin

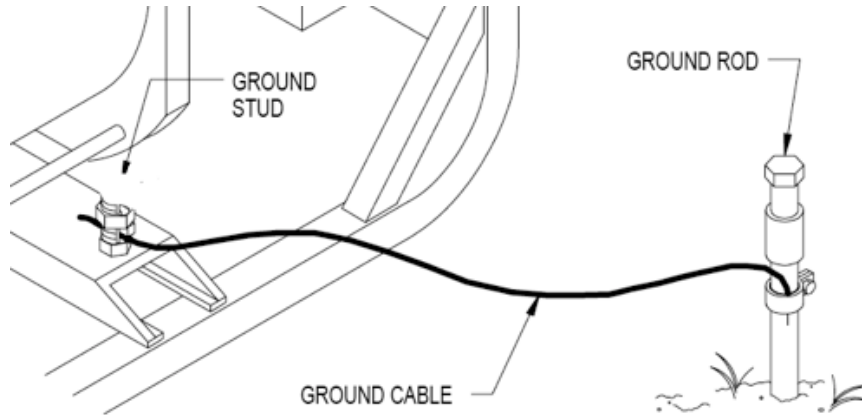
Observe WARNINGS, CAUTIONS and INSTRUCTIONS contained in this manual and on plates or decals located on the generator. Do not operate if there is any deficiencies or irregularities or you do not fully understand the operation of this equipment and any hazards.

Operator Preventive Maintenance Checks and Services

- Check load terminals, sockets and outlets for any irregularities or deficiencies.
- Check for any loose hardware, terminal, or fasteners. The starter battery terminals must be tight.
- Insure proper grounding.
- Make sure main circuit breaker is in the OFF position
- Check air intake cover wing nut for security. Tighten if necessary
- Inspect fuel filter assembly for damage and security.
- Check fuel filter bowl for water or other contaminants. Inspect fuel system for loose or missing fuel line clamps, damaged fuel lines, and leaking/damaged fuel tank. Check for evidence of fuels leaks
- Check fuel level and if necessary, service fuel tank to red line on fuel strainer. Ensure fuel tank fill neck strainer is not clogged or damaged.
- If you find any oil in a new generator, it is from factory testing. It must be removed, engine flushed and replaced with new lube oil.
- Ensure generator set is level and check diesel engine lubricating oil level using oil fill cap/dipstick. Add oil if required.
- Inspect the diesel engine and surrounding area for oil leaks.
- Inspect cooling fins and air intake slots in recoil starter cover for damage and debris restricting air flow over and through cooling fins. Remove debris. Check recoil starter assembly for damage and operation.

Electric Starting

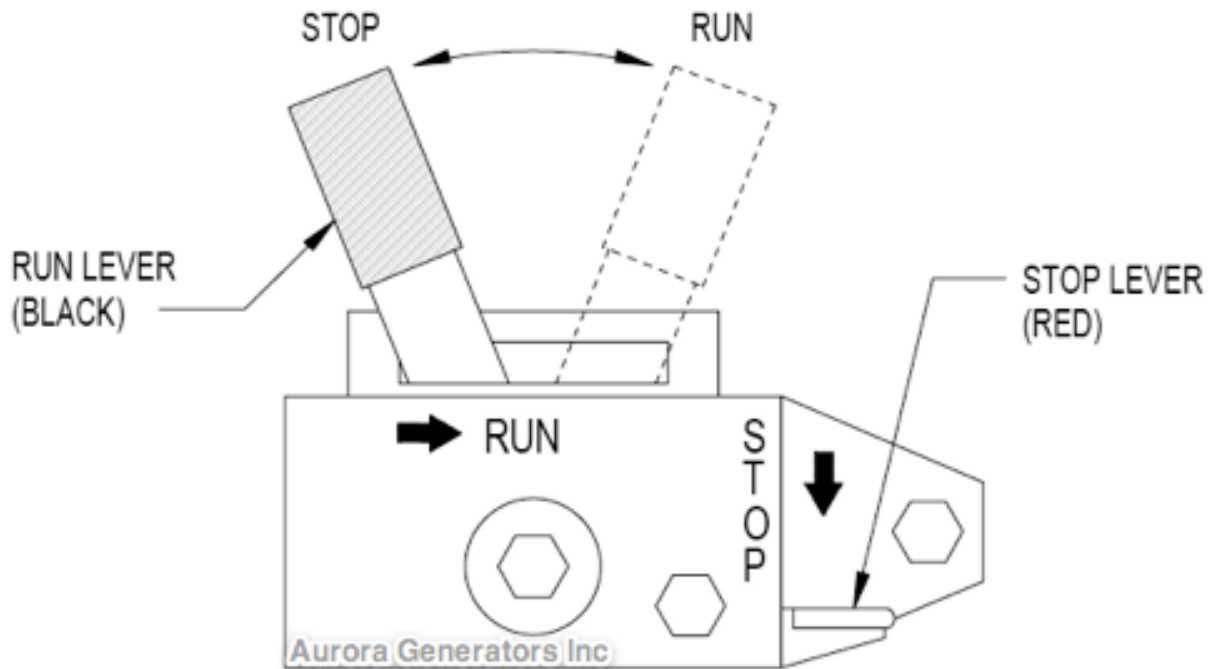
1. Ground generator. Never attempt to start the generator set if it is not properly grounded. Failure to observe this warning could result in serious injury or death by electrocution. Drive an eight-foot (or longer) ground rod into ground until clamp on top of ground rod is just above surface. Connect a 6 AWG minimum to the ground terminal on your generator.



2. Switch main circuit breaker OFF (Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.)
3. Connect load cables to load terminals
4. Perform the Preventive Maintenance Checks and Services
5. Ensure fuel shut off is in the OPEN position
6. Move the engine RUN lever to RUN position
7. Do not crank engine more that 10 seconds without allowing the starter to cool for at least 15 seconds between attempted starts. Over cranking can damage the starter. Turn the START switch clockwise to the START position and release when the engine has started.
8. If the engine fails to start you can utilize the engine preheater and decompression lever.
9. If the engine fails to start repeat steps 6 to 7
10. If the engine still fails to start after two attempts refer to the troubleshooting guide.
11. Once the engine is running, check any gauges to insure proper operating conditions. Voltage and Frequency should be correct. Under normal conditions allow diesel engine to warm up for five minutes before applying a load. If necessary the load can be applied immediately.
12. Switch the mains circuit breaker to the ON position to apply a load.

STOPPING THE GENERATOR

1. Remove the load from the generator by turning OFF the mains circuit breaker
2. Turn the starter key to the OFF position
3. If generator fails to shut off, press the red stop lever to release the throttle and refer to the troubleshooting section of this manual.



A decompression lever on the engine helps the operator start the engine when it is extremely cold, when the battery is low, or when bleeding the fuel system. Caution: The decompression lever must never be used to stop the engine except in emergencies such as a run away engine or throttle damage as serious damage can be done to the exhaust valves.

INITIAL SETUP

Your generator has been run and load tested at the factory to insure it meets specifications. A external fuel tank has been used and all the fuel that remains is in the fuel filter and fuel lines. Most of the lube oil has also been removed. If you find any oil in a new product, it must be flushed and replaced. Oil and fuel is considered hazardous material. For shipping, most if not all fluids are removed. You must add lube oil and fuel before you can begin to use your generator. The battery must be fully charged then connected before using it and you must have read and understand the complete instructions. If you are not sure of anything, call Aurora Generators at 1-877-510-6807 or email technical support at Support@AuroraGenerators.com

Engine Lube Oil

The main purpose of engine oils is to lubricate moving parts of the engine to reduce friction and wear and tear by providing smoothing, trouble free performance for increased length of time. In a diesel engine it also helps to seal the high-pressure combustion gases inside the cylinders, to impede the corrosion of metal parts, to absorb some of the harmful by-products of combustion, and to transfer heat from one part of the engine to another. Combustion of rich air-fuel mixture during starting, idling and warm up form deposits. These deposits in the form of varnish, sludge, soot and carbon, interfere with proper engine operation. The engine oil keeps all the deposit forming material in suspension and gets rid of them by oil filter, or draining out at proper intervals.

Engine oil is stored in the oil pan or sump at the bottom of the engine. A pump forces the oil through a filter and then through a series of passages and galleries to lubricate the engine's moving parts. The flow of also cools these parts. Rapidly moving engine parts actually float on a thin film of oil and never make contact with one another. This is called hydrodynamic lubrication and usually begins when an engine reaches the idle speed. When the oil is cold or the engine has not been run for a long period of time, it takes a while before oil reaches its normal operating pressure an flow. During this time is when most engine wear occurs.

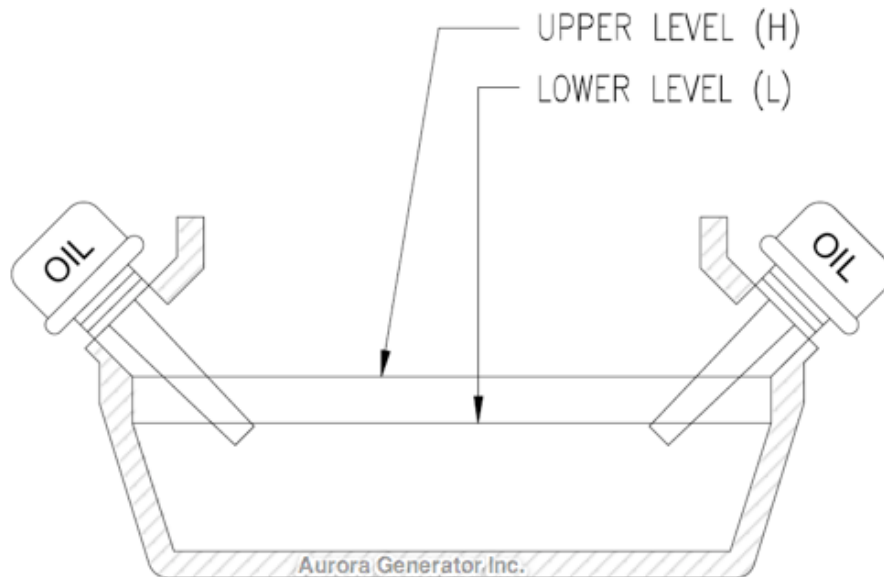
When possible, wait five minutes before applying a load to your generator.

ONLY use lube oil designed for diesel engines.

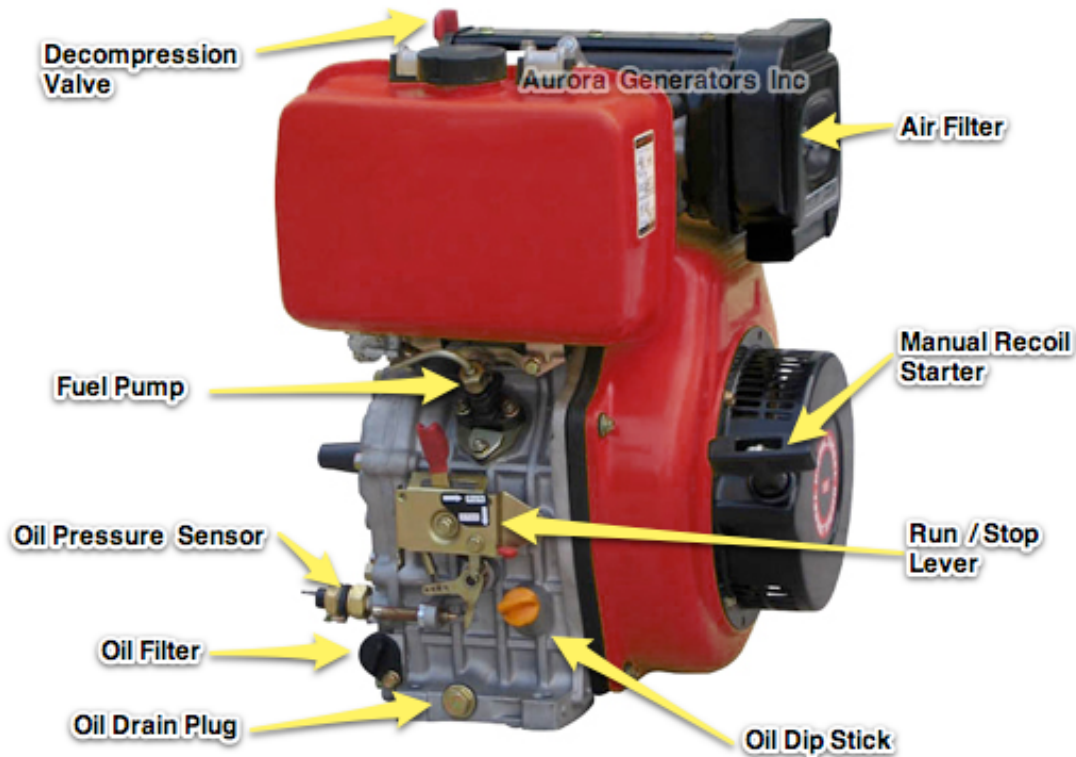
Regular lube oil used in gasoline engines is not designed to work with the much higher temperatures diesel engines produce internally. Using regular lube motor oil will damage your engine and void your warranty. The wrong lube oils also breaks down from the higher level of sulfur and oxides the burning diesel engine produces. When in the presence of water, sulfur acids cause corrosion of engine parts. Hence the need of alkalinity reserve in the oil which is represented by its TBN or Total Base Number.

Generally, the higher TBN value more the alkalinity reserve or acid neutralizing capacity the oil contains.

Your generator requires 15W40 diesel lube oil only. For the first 25 hours a non synthetic lube oil is required. After the initial 25 hour break in process, synthetic diesel engine lube oil 5w40 to 15w40 is required.



The engine is designed in such a way that it is difficult to overfill it and as you can see in this illustration above oil should be filled until it reaches just below the oil filter neck.



Regardless of how little you may use your generator the oil on its own will break down losing some of its properties in 3 months. The same applies to your vehicle. You must replace it every 3 months. If you use your generator within that time, the oil should be changed every 100 hours or earlier. There is nothing you can do that will add more life to your engine then regular oil changes. This is very important and is the leading cause of engine failure.

Add Diesel Fuel

Diesel fuel only should be used. The regular diesel fuel you find at the gas station used for cars only. Not off road vehicles, farm or construction. Some Bio Diesels that are safe for cars are also safe for your generator however there are many different types and we can't guarantee the quality or that it will not damage your engine. While a diesel engine can run on many different types of fuel such as vegetable oils and other bio diesels some can clog the fuel filter, fuel injector and fuel pump. A grain of sand is all it takes to plug a fuel injector! Do not use old fuel. Fuel does go bad over time. Diesel Fuel is also used as a lubricant to lubricate the fuel pump, injector and fuel valves. Now with new low sulfur fuels on the market the sulfur that used to give diesel fuel some of its lubrication properties have been lost. For optimal performance we do suggest fuel additives be used especially in cold climates. This topic is covered on another page in more details.

Warnings

- Close all fuel valves

- Insure when filling that no fuel is spilling or leaking for any hoses or filters.
- When filling from oil drums, ensure that no dirt or water enters the fuel tank.
- Contamination can cause serious fuel system problems.
- Never over fill the fuel tank.
- Filling should only be done in a well-ventilated area with the generator turned off.
- Never refill while the generator is running. Spilled fuel can ignite on a hot surface.
- Clean up all spills and ensure that area is dry before starting the generator.
- Do not use old fuel

Under some fuel tanks is a fuel shut off valve. When filling or transporting your generator it must be off. The valve should be in the open position when you are using your generator. Some people forget to open it and either can't start the engine or cause air to be sucked into the fuel pump if it can't get the fuel supply it requires. If your generator has fuel filter make sure to check the fuel valve on it also. The valve on the fuel filter assembly maybe the only one you have.

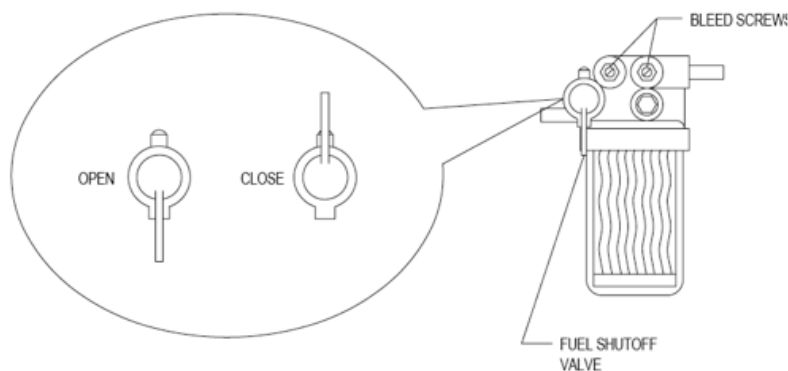
Priming and Bleeding the Fuel System.

<http://www.youtube.com/watch?v=uQLkLtUdgh4&>



Under normal conditions, the fuel system does not require priming. Certain conditions may allow air into the fuel system such as running out of fuel. Once this occurs, the air must be bled before the engine will start or run smoothly again.

The engine fuel pump can only pump fuel, it can't pump air. Air in the fuel lines will make it impossible to start your engine. Air bubbles can also damage your fuel injector and will cause rough engine operation since the fuel being delivered is not a consistent flow. If there is some air in the fuel delivery system it may take up to 15 minutes to naturally be purged through. The engine may not run normally during this time.



Note: Not all fuel filter assemblies have the bleed screws on the top. You may have to remove the rubber fuel line from the fuel pump to achieve the same thing.

Warning - Hot fueling of generator sets while they are operating presents a safety hazard and should not be attempted. Hot engine surfaces and sparks produced from

the engine and generator circuitry are possible sources of ignition. Failure to observe this warning could result in severe personal injury or death.

1. Check that fuel tank has fuel and that fuel shutoff valve located on the filter is positioned to ↓O (open).
2. Open two bleed screws at top of filter in the order listed below.
 - (a) Open left bleed screw to bleed air from tank-to-filter fuel line.
 - (b) Open right bleed screw to bleed air from filter to pump fuel line. It may be necessary to squeeze line by hand to force air out of bleed screw.
3. When fuel flows freely and evenly out of bleed screws (without air bubbles), tighten both bleed screws.
4. Loosen output fuel line fitting at fuel injection pump, place engine RUN lever to RUN position, depress and hold decompression lever, and pull recoil starter rope until fuel flows from around fuel line fitting (without air bubbles). Tighten output fuel line. If you have an electric start version you can crank the engine for short periods of time to do the same thing.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

Within designated intervals, these checks are to be performed in the order listed.

M-Monthly Q-Quarterly S-Semi-annually A-Annually B-Bi-annually H-Hourly

Item	Interval						Item To Be Inspected	Procedure	Generator should not be used if
	M	Q	S	A	B	H			
	x						Diesel Engine	Check for loose, damaged, or missing parts. Tighten loose parts. Repair or replace damaged or missing parts. Inspect decompression lever for debris. Clean if needed.	Engine parts are loose, damaged, or missing.
	x						Starter Battery	Check battery terminals are secure. Recharge battery if not in use.	
						50	Primary and Pre-filter Air Filter Elements	Inspect for clogged primary (paper) air filter element. Clean every 50 hours or as required, or replace element if damaged. Replace pre-filter (foam) element.	Air cleaner element is clogged or damaged.
	x						Ground Terminal Lug	Check for damage or corrosion.	
	x						Control Panel	Check for any loose hardware or corrosion.	
						20 (1st Time) 100	Engine Lube System	Change diesel engine oil after the first 20 hours of operation and then after every 100 hours. (1) Remove diesel engine oil drain plug and collect oil in an appropriate chemical resistant container for disposition/disposal. Remove, clean, and install oil strainer. Add proper lube oil. 15W40 Synthetic	
						100	Fuel Filter Element	Replace fuel filter element. Inspect gaskets for damage	
						50	Spark Arrestor	Check for damaged, missing or corroded spark arrestor if present.	
						1000	Alternator Brushes Wires and Holders	Check for worn alternator brushes. Length must be a minimum of 0.5 in. (1.3 cm). Check for damaged or missing brush caps, wires, and holders.	Alternator brushes worn. Damaged or missing brush caps, wires, and holders

						20 (1st Time) 500	Intake and Exhaust Valves	Adjust valve head clearance after the first 20 hours of operation and then every 500 hours.	
						500	Primary and Prefilter, Air Filter Elements	Replace air filter elements	
						20 (1st Time) 200	Cylinder Head Nuts	Check after first 20 hours of operation and then every 500 hours. Check for loose head nuts. Torque cylinder head nuts.	Head nuts are loose.
						1000	Fuel Injector	Replace every 1,000 hours.	
						2000	Fuel Injection Pump	Replace fuel injection pump.	
			x				Generator Set, Engine/ Alternator, and Control Panel	Check for damage, corrosion, missing, or loose attaching hardware	Damaged, corroded, missing, or loose hardware
			x				Fuel Lines	Inspect for breaks and/or damage. Replace damaged fuel lines.	Fuel lines leak or show signs of wear or damage
			x				Fuel Tank	Check for damaged, corroded, or missing fuel fill strainer, tank cap lug, and retaining rope.	Damaged, corroded, or missing components
			x				Alternator	Check for damaged flexible sleeve coupling and flexible flange couplings	Damaged alternator coupling components
			x				Control Panel External	Check for damaged, corroded, or missing convenience receptacle and cover (MEP-531A); LOP engine shutdown cable grommet and cable guide; and slave receptacle.	Damaged, corroded, or missing control panel components.
			x				Control Panel (Internal)	Check for any loose wiring, damaged or bruned wires and insulation on all electrical leads and harnesses. Ensure that protective cover on rear of instrument panel is secure.	Damaged control panel components
			x				Electrical Outlets	Check for damaged or corroded load terminals, electrical outlets, plugs and any fasteners.	Damaged or corroded load terminals or receptacles

			x				Generator Set	Check ground strap for damage.	Damaged ground strap.
			x				Low Oil Pressure (LOP) Engine Shutdown Cable	Check for damaged push-pull cable and tube. Check cable adjustment.	Damaged or misadjusted LOP engine shutdown cable
			x				Air Preheater Lead	Check for damaged or missing tubing and protective boot; damaged or burned wires and insulation.	Damaged air preheater lead
			x				Engine Wiring Harness	Check for damaged, missing, corroded clamps; damaged or missing tubing and protective boot; and burned insulation.	
			x				Alternator Wiring Harness	Check for damaged, missing, corroded clamps; damaged or missing tubing and protective boot; and burned insulation	Damaged, missing, or corroded generator wiring harness components
						2000	Resilient Mounts	Replace resilient mounts after 2000 hours	
				x			Frame	Check for damage and corrosion.	Damaged or corroded frame
				x			Fuel System	Check for damaged or corroded fuel tank brackets and guard.	Damaged or corroded components.
				x			Engine/ Alternator	Check for damaged, corroded alternator guard, brackets, engine mounting bracket, and fuel filter stiffener	Damaged or corroded components.
				x			Air Intake System	Check for damaged or corroded air filter plate and air filter cover.	Damaged or corroded air intake components
				x			Exhaust System	Check for damaged or corroded muffler and shroud; damaged or missing grommet; damaged muffler blanket; damaged, missing, or corroded retaining wire.	Damaged or corroded exhaust system components
				x			Alternator	Check for damaged engine adapter and damaged or corroded support bracket	Damaged or corroded alternator components

DETAILED PREVENTIVE MAINTENANCE PROCEDURES

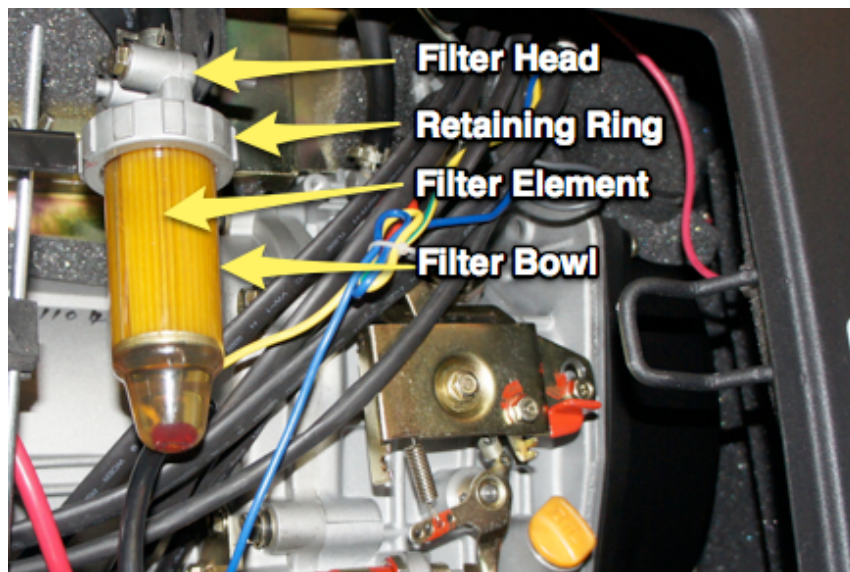
Fuel Filter Replacement

Removal

1. Shut down the generator set
2. Close the fuel shut off valve
3. Unscrew the retaining ring and separate the bowl and head using care not to spill diesel fuel trapped in the bowl. Then pour diesel fuel into suitable container
4. Remove and discard fuel filter element and gasket

Installation

1. Clean bowl with clean cloth
2. Install new fuel filter element in bowl.
3. Lubricate new gasket with clean diesel fuel and seat in land of bowl
4. Assemble bowl to head and hand-tighten retaining ring
5. Prime and bleed the fuel system



Air Filter Element Replacement.

Removal

1. Shut down the generator set
2. Remove 4 nuts securing metal cover on the silent diesel generator to expose the air filter assembly inside the enclosure.
3. Remove the wing nut
4. Remove the pre filter element
5. Remove the paper element
6. If necessary, remove gaskets from mounting plate and cover. Clean adhesive residue from surfaces

Inspecting and Cleaning

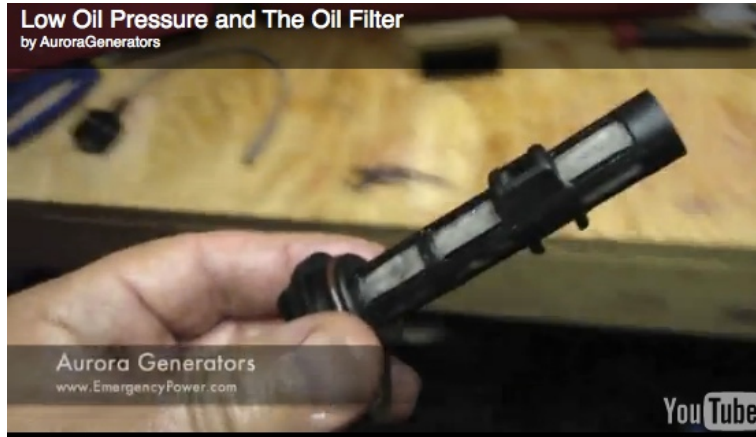
1. Inspect cover for cleanliness, cracks and other damage. Clean cover with mild soap and water.
2. Inspect filter element for cleanliness, dents, and crushed corrugations
3. Replace damaged parts.
4. Replace filter element if dirty
5. Replace pre-filter.

Installation

1. If removed, install new gaskets on mounting plate and cover
2. Soak new pre-filter in clean engine oil and squeeze out ALL
3. Install pre-filter over filter element. Pre-filter should fit snugly over filter element
4. Position filter element with pre-filter and cover on mounting plate
5. Install wing nut.

Oil Filter Replacement

This video shows the oil filter service on a disassembled engine for reference only. There is no need to disassemble the engine.



<http://www.youtube.com/watch?v=YZ0p8hVF7D4&>

1. Remove oil filter retainer screw
 2. Twist or pull of oil filter
 3. Rinse off in soap and water and let dry.
 4. Inspect rubber o-ring and replace if necessary.
 5. Lubricate o-ring before replacing.
 6. Insure oil filter in inserted all the way into engine block and o-ring is not pinched.
- This video shows oil filter replacement on a disassembled engine. There is no need to disassemble your engine it is for educational purposes only.

Fuel Pump Service & Replacement



<http://www.youtube.com/watch?v=a1ZrAAYGt40&>

Fuel Injector Replacement.

Removal

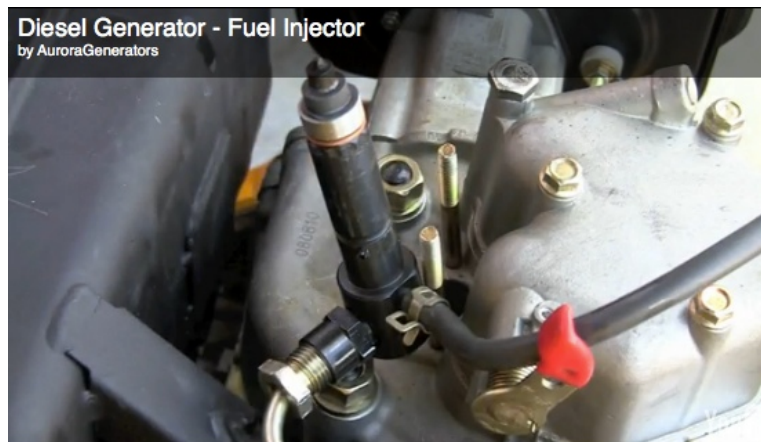
1. Shut down generator set.
2. Disconnect pressure and return fuel lines from fuel injector.
3. Remove nuts and retainer from cylinder head.

CAUTION To prevent damage to nozzle tip, wrap fuel injector in a clean cloth after removal. Do not place unprotected nozzle tip directly on dirty surface.

4. Pull fuel injector straight out of cylinder head, wrap in clean cloth, and remove spacer and gasket. If gasket (black plastic) remains in cylinder head, use a bolt (5/16 in. diameter) that will thread into gasket to remove.

Inspection

1. Inspect injector for nicks, cracks, scoring, corrosion, and other damage.
2. Inspect nozzle tip for carbon deposits. Carefully clean deposits from nozzle body and clean nozzle injection ports with 0.019 in. diameter wire



http://www.youtube.com/watch?v=jq6_bY5zfl8&

Installation

1. Clean fuel injector sleeve surface in cylinder head.
2. Install new gasket, spacer, and fuel injector in cylinder head. Ensure fuel injector is positioned to connect pressure fuel line prior to securing in cylinder head.
3. Secure fuel injector in cylinder head with retainer and nuts. Torque nuts evenly to 7-9 lbs-ft (9-12 Nm).
4. Connect pressure and return fuel lines. Bleed fuel system if necessary

Engine & Alternator Resilient Mounts Replacement.

Cylinder Head Nuts Tightening.

1. Clean fuel injector sleeve surface in cylinder head.
2. Install new gasket, spacer, and fuel injector in cylinder head. Ensure fuel injector is positioned to connect pressure fuel line prior to securing in cylinder head.
3. Secure fuel injector in cylinder head with retainer and nuts. Torque nuts evenly to 7-9 lbs-ft (9-12 Nm).
4. Connect pressure and return fuel lines. Bleed fuel system if necessary, Install gasket and valve cover on cylinder head with bolts.
5. Tighten fuel line connecting nut and bleed fuel system if necessary

Intake and Exhaust Valve Adjustment.

Perform valve adjustment when engine is cold. Procedure is the same for intake and exhaust valve.

1. Remove bolts securing valve cover. Then remove valve cover with gasket.
2. Remove cooling fan cover, refer to paragraph 4.53.b.
3. Align T mark on flywheel with V notch on cylinder body fin

This video shows the above procedure.

<http://www.youtube.com/watch?v=J64VghmSsBc&>



Ensure both valves are fully closed (both rocker arms have free play).

4. Loosen nut for adjusting screw and adjust screw until correct clearance [0.006 in. (0.15 mm)] is achieved between rocker arm and valve cap

Aurora 186F Diesel Engine Specifications

Valve timing, initial angle of fuel delivery and valve clearances in degrees.	
Intake Valve Open	BTDC 13°
Intake Valve Close	ATDC 52°
Exhaust Valve Open	BBDC 57°
Exhaust Valve Close	ABDC 8.5°
Initial angle of fuel delivery	22° ± 1°
Intake valve clearances	0.10-0.15 mm cold
Exhaust valve clearances	0.10-0.15 mm cold
Injection Pump Pressure	19.6 ± 0.49 (200 ± 5) MPa(kgf/cm ²)

Torque Specifications in SI units Newton Meters	
Connecting Rod Nut	40-45
Cylinder Head Nut	55-60
Flywheel Nut	120-140
Fuel Injector Nozzle retainer nut	12 - 120
Rocker Support Bolt	25 - 30
All Standard M8 Bolts	20 - 30
All Standard M6 Bolts	15 - 20

Note: adjustments should be checked a second time after a short test period.

The Break In Period

The diesel engine must be broken-in, avoiding heavy loads (no greater than 75%), for a period of twenty (25) hours to ensure proper operation of the generator set. After the initial break-in period, engine lubricating oil must be changed, cylinder head nuts torque must be checked, and intake and exhaust valve clearances must be checked and adjusted.

Current technology provides the means of manufacturing engine parts with unimaginable precision however they still far short of achieving the near perfect fit that a proper break-in will provide. Break-in, is the allowance of the machined parts in the engine engine to conform to each other. This conforming or mating specifically of the ring and cylinder surfaces is the ultimate goal of a proper break-in. Mating these two specific parts will produce a very tight seal in each cylinder. A tight seal is very important because of the intense pressure diesel engines operate under. Mating helps prevent the escape of unburned fuel and pressurized gasses into the crankcase, while further preventing crankcase oil from entering the cylinder above the top compression ring. The blow by also causes a loss of pressure and results in lack of power.

It is normal to find metal shavings trapped in your oil filter during this break in process. Clean your oil filter normally.

Friction causes heat and until the break in occurs extra heat and most of the ware and tear will happen during this period. Break in your engine before using it! Don't forget oil will become contaminated faster because of combustion blow by fumes and metal that is ground away during the mating process. The oil should be changed at at the first 25 hours. This is an important time for an engine. You should not subject the engine to significant loading for the first 25 hours or more however some load IS desirable since the heat and friction is also needed for the break in to occur. Excessive heat will burn oil and cause it to harden leaving an enamel like residue on the cylinder wall, commonly known as oil glazing and prevents the mating from occurring so small gaps between rings and cylinder surfaces will never seal. The same applies to use synthetic oil during the break in period. It will also prevent break in from happening. Only use synthetic oil after the break in period. **A moderate loading is the key to a proper break in.** 1/2 the rated power may be ideal. While some manuals suggest decreasing the RPM it is not easy to do on generator motors since they have a fixed run or stop position that locks into place on the throttle. If you can, secure it for this process for a break in period so are running it at half the RPM you will benefit from it in the long run. Obviously you can not use the generator until the normal speed is restored.

Improper Generator Use - Wet Stacking

"Wet Stacking" happens when a diesel engine operates below the rated output level the engine starts over-fuel or "wet stack". Diesel engines are designed to operate with a load and operate more efficiently in the 70 to 80% range of rated output. When a diesel

engine operates for a long period of time below 40% it begins to over fuel. This happens because the injection tips begins to carbonize and disrupt the fuel spray pattern. The only way to correct a diesel engine if it has begun to wet stack is to load the engine for a couple of hours to burn off the excess fuel and clean up the engine. Diesel generator sets with electronically controlled engines or advance emission systems are less likely to wet stack. But all diesel engines will wet stack unfortunately, if operated for long periods of time below rated levels. This is the reason it is important to get the proper size and design of a diesel generator set.

Cold Weather Usage

Diesel fuel thickens in cold weather. It has a tendency to gel as it contains some naturally occurring paraffin (wax) and as the temperature drops, this paraffin crystallizes and affects the fluidity of the fuel and may cause hard starting and eventually lead to filter plugging. You can use a fuel additive to prevent this.

Regular diesel fuel is winterized or seasonally adjusted at the distributor before it is delivered to the pumps.

In cold weather fuel does not vaporize very well in the combustion chamber this makes starting difficult. Modern diesel engines designed for cold weather use a pre heater and glow plugs. Glow plugs are heating elements that work on a timed circuit or are manually activated just before the engine is started. The colder it gets, the longer those glow plugs need to stay on to preheat the combustion chamber for a smooth start.

Batteries that are weak may not crank the starter motor fast enough or long enough to start a cold engine. As the temperature goes down, so does battery capacity. A battery that has all of its power available at 80 degrees F will have only about 46% available power at 0 degrees F. Plus, the engine will be 2.5 times harder to start at 0 degrees due to thicker oil and resistance to movement of internal moving parts. In effect, an engine is about five times harder to start at 0 degrees F than at 80 degrees F. Test weak or suspicious batteries under load before cold weather to help eliminate potential problems during busy times. If batteries need replacement, always replace with a battery equal to the original battery.

Two different types of preheat elements seen after air filter has been removed. Before starting heater gets red hot warming up air.. Seconds later when the starter kicks in the generator pulls in this heated hear causing the diesel fuel to vaporize and ignite easier. If you can press and hold the decompression lever a second while cranking and let go, it will also help in the cold starting process. Use glow plugs or block heaters on the engine for cold weather starts. Glow plugs heat the internal combustion chamber area or preheat the air intake to suitable temperatures for combustion. Otherwise, cold fuel sprayed into the chamber and onto the glow plugs can gel and adhere to these parts. Hard starting and inefficient combustion occur with potential for damage to plugs and cylinder heads. Use Number 1 diesel fuel in cold weather. It is more volatile than

Number 2 fuel and ignites more readily under cold conditions. Keep the fuel tank full to prevent condensation inside the tank.

Water from condensation can freeze and plug fuel lines from the tank to the engine. Add winter diesel fuel additive to the fuel to lower the possibility of gelling and improve starting. Store generators inside tool sheds, barns, garages or other suitable locations that are heated or warmer than outside temperatures. Only a few degrees warmer temperature can make starting faster and easier. The warmer the battery is, the more power it can provide to the starter motor to crank the engine. The warmer the engine oil is, the thinner it will be and have less resistance to moving engine parts. Make sure you are using the proper viscosity oil recommended for your engine for cold temperatures. If you cannot store engines inside or in a heated area, install a block heater on the engine. To save time and electricity, put the block heater on an electrical timer set to come on a couple of hours before you plan to start the generator. After starting the generator on a cold day, allow the engine to warm up a few minutes before putting it under load. Proper engine operation temperatures assure more efficient fuel combustion and may prevent damage to cold engine parts. Engine oil flows more readily at operating temperatures and allows proper lubrication of engine parts and areas.

Tips, Tricks and Things You Should Know.

Batteries

Generator batteries are often required to be float charged for long periods of time and must be able to deliver high current when called upon. Generator batteries are often sealed and maintenance free. Lead Acid batteries are often used however because the content is an acid it is considered a hazardous material and often can not be shipped. If your generator comes with a dry battery then you may be required to get it filled at Napa Auto Parts for example the charge is minimal. Most generators sold here come with sealed maintenance free batteries and do not need to be filled.

A lead-acid battery is composed of a series of plates immerse in a solution of sulfuric acid. Each plate consists of a grid upon which is attached the active material (lead dioxide on the negative plates, pure lead on the positive plates.) All of the negative plates are connected together, as are all of the positive plates. When the battery is under load and being discharged, acid from the electrolyte combines with the active plate material. This releases energy and converts the plate material to lead sulfate. The electrolyte become less acidic in the process. When a battery is recharged, the opposite occurs: the lead sulfate reverts back to active material, and the electrolyte becomes more acidic with a higher specific gravity.

To recharge a lead-acid battery, it is necessary to convert the lead sulfate material which attaches to the discharged areas of the plates back to active plate material. If the battery has not remained discharged for long or has only been discharged slightly, this is a relatively easy process. However, when the battery has remained discharged for an extended period or has been subjected to repeated deep-discharges without charging fully between cycles, the sulfate material can harden into crystals which are more difficult to convert. Until the sulfate is converted, the sulfated portions of the plates are useless, and the battery can accept and hold only a partial charge. Eventually, sulfating can ruin a battery.

The number one cause of battery failure is Sulfation

Whenever possible, bring any batteries up to full charge as slowly as possible. This slow charging process is also known as equalization. Equalization allows the electrolyte time to diffuse into the less accessible areas of the plate grid and convert those areas from lead sulfate to active plate material. Infrequently-used or stored batteries are also prone to sulfating if not kept fully-charged between uses. A battery loses approximately 1 percent of its charge per day (up to 2 percent in hotter climates) due to self-discharge. If self-discharge is not compensated for, a stored battery can become sulfated and will eventually be ruined. The second most common cause of battery failure is overcharging. Many chargers on the market will damage your battery if left attached for extended periods by "boiling" the water out of the electrolyte solution. Eventually, water loss will destroy a battery. Checking the electrolyte level in a battery and adding distilled water when necessary is extremely important, especially when using fast chargers or many of the trickle chargers on the market. Maybe buy a small trickle charger and leave it on full time or hook up a small solar cell to keep the battery topped up when not in use.

If you plan on storing your generator and not using it for a period of time it is advised that you keep a small charger on it to prevent the battery from self discharging. You can buy a small trickle charger from an automotive store and leaving it hooked up to your battery when the generator is not in use. * Deep discharges are the number one cause of battery failure.

The starter needs a lot of power to crank the engine. Slow cranking from a weak battery will cause difficult starting or even make it impossible to start. Slow cranking results in low compression and less heat necessary to ignite diesel fuel.

Why diesel engines last longer.

When it comes to generators diesel wins hands down. The engines are simple, there is less maintenance. Diesel generators are built tougher to withstand the higher compression ratio diesel burns at compared to a gas engine. Less maintenance means more up time and more reliability when they are needed the most. There are many technical reasons why to choose diesel over gasoline however the point of this document

is to help identify some important things necessary to truly benefit from diesel and insure your generator continues to run long after its equivalent gasoline generator has died.

Diesel engines operate at twice the compression ratio of gasoline engines; create greater internal pressures and heat. Components are made to closer tolerances, therefore are more easily damaged by dirt, corrosion improper fuel and lubricants.

Diesel injectors are expensive precision parts that handle fuel pressures as high as 137,900 kPa. Using correct diesel fuel is essential because it not only runs the engine, but also lubricates and cools the fuel pump, injectors and spray tip. Dripping or leaking injectors can cause rough engine operation, destructive unbalanced cylinder temperatures, crankcase oil dilution and incomplete combustion.

Because of diesel fuel's acid content, combustion byproducts are more corrosive. Greater diesel heat also converts combustion byproducts to varnish inside the engine more rapidly.

Dirt and water by passing fuel filters can badly score fuel pump and injectors, requiring replacement. Rust can cause sticking in pump pressure regulator valves. Water in fuel can also cause hard starting, uneven running and frequent stalling. Because diesel engines breathe more air per hour than gasoline engines, air leaks through cracks, loose connections or holes in flexible hoses can cause serious and expensive engine damage.

Clogged air filters reduce power. Diesel engines make more use of oil as coolant because of greater heat and pressure. For example, the oil cools piston undersides. Improperly or inadequately filtered oil can cause scoring and damaging of engine parts. Inadequate circulation of oil and coolant can cause engine overheating and thermal distortion.

Poor quality fuel can cause hard starting, incomplete combustion with varnish buildup, smoky exhaust, and plugged fuel filters in cold weather. Don't let the above scare you, there is a far greater list for the problems you can and often will encounter with a gasoline engine. Remember most of this is for information purposes and to help you get the maximum life out of a diesel generator.

About Motor Oil

Engine oil has limited life - after a certain point it starts losing lubricating qualities and carbonizes. Once it happens, the engine gets contaminated with carbon deposits or sludge that significantly shorten engine's life. When you change oil at or before manufacturer suggested interval, you change the oil before this "carbonizing" point, engine remains clean and once refilled with new oil ready to work hard again. If the engine oil has not been changed for long, carbon deposits start clogging the oil pickup screen decreasing oil supply and increasing friction. Compression decreases and engine start wearing much faster. If you don't remember when you changed the oil last time - just check the oil on the dipstick. And every time you change the oil, the oil filter

should be replaced as well. We suggest you change your oil after the first 25 hours and then every 100 hours or sooner. The cost of the oil is far cheaper than the cost of a new engine. This is an area where you have great control over how long our generator will last.

The advantage of synthetic oil is that it can withstand higher temperature and can work longer without losing its lubricating qualities. It doesn't get thicker at below-zero temperatures providing good engine lubrication at a cold start. After your generator's first oil change and initial break-in period a good quality synthetic oil designed for diesel engines is recommended. Mobil1 is one of the best ones you can get however make sure what you buy is specifically for a diesel engine.

About Diesel Fuels

Diesel fuel is principally a blend of petroleum-derived compounds called middle distillates (heavier than gasoline but lighter than lube oil) and may or may not contain additional additives. Other middle distillates include kerosene and No. 2 Heating Oil. Diesel fuel is designed to operate in a diesel engine where it is injected into the compressed, high-temperature air in the combustion chamber and ignites spontaneously. This differs from gasoline, which is ignited in a gasoline engine by the spark plugs.

Ultra-low sulfur diesel (ULSD) will begin replacing conventional diesel fuel starting in 2006. The new fuel will contain 97% less sulfur than conventional diesel—sulfur will be reduced from 500 parts per million (ppm) to 15 ppm. Sulfur was the main lubricating property of the fuel. Since the removal of Sulfur from Diesel Fuel diesel shops have been flooded with work caused by lack of lubrication in the new fuels. Cars, Trucks and generators can all see the effects of this. Fuel Injector and Fuel pump failure can be common if the lubrication is not restored by some means. Leading diesel manufacturers now recommend using a fuel additive such as Stantadyne with every fill up to restore to restore the lost properties from removal of Sulfur from Diesel Fuel. You should also be using a fuel additive to avoid similar problems. [Stanadyne White Paper on Diesel Fuel](#)* What is the difference between gasoline, kerosene, diesel fuel, etc? Visit the [How Stuff Works](#) web site. * [Vegetable Oil is Used as Fuel](#) * Exxon Diesel Fuel FAQ

How Diesel Engines Fail

Most diesel engine problems are related to the injection system. As such diagnosing diesel engine problems requires knowledge of engine and injection system operation. Excessive diesel smoke is due to incomplete combustion, normally caused by faulty injection system or other engine



troubles. A small amount of exhaust smoke is normal during initial start-up or rapid acceleration. Excessive black smoke is caused by a rich air-fuel mixture. This may result from problems with the injection pump or injection timing, which may in turn be clue to a choked air cleaner, worn fuel injectors, adulterated diesel fuel or the engine itself. White smoke occurs mainly during cold starts, when the fuel tends to condense into liquid and does not burn due to cold engine parts. The most common reason for white smoke are in-operative glow plugs low engine compression, a bad injector spray pattern, late injection timing or injection pump problems. Excessive blue smoke indicates problems from low engine compression and/or worn piston rings, scored cylinder walls or leaking valve stem seals. The blue smoke is caused by crankcase oil entering the combustion chamber and being emitted after partial combustion through the exhaust.



As fuel manufacturers remove sulfur from fuels in the refining processes, as well as blending with No. 1 diesel and kerosene, the lubrication properties of fuels are reduced. This leads to increased wear in the fuel injection system. Aftermarket additives help prevent this wear with extra strength lubricants. Do not use Alcohols.

As temperatures drop, paraffin crystals precipitate from the fuel forming the waxy substance on the filters which blocks fuel flow. This "freeze-up" condition can be avoided by using a Wax Dispersant, which keeps wax crystals evenly distributed throughout the fuel, thus assisting in the prevention of wax clogging the fuel system. The Wax Modifier-Pour Point Depressant they use will lower the temperature at which fuel will continue to pour by up to 40° F. Also, there is a Freeze Depressant, which will lower the freeze-point of water in fuel. This can help to prevent damage from or the clogging of fuel lines with ice.

Residual carbon deposits from combustion can build up in nozzles and around the orifices and can obstruct the atomization of the fuel into the air preventing complete combustion. Deposit Modifiers and Detergents soften the hard deposits allowing for their removal. The Detergent will clean the soft deposits and prevent additional deposit build-up. Also, they incorporate an Anti-Oxidant, which helps fuel maintain its potency and a Corrosion Inhibitor to help protect fuel injection parts from rust and corrosion.

Fuel Pump Engine Stop Solenoid

To turn off a diesel engine the fuel supply must be cut off. There are two ways to do this. One way is by releasing the throttle (run stop lever) the other is by cutting off the fuel that goes to the fuel pump.

Some engines use an electric fuel switch mounted on the fuel pump. You see it on the right side of this photo. It has one wire connected to it.

The fuel valve is opened by applying 12 volts the top terminal. When powered it causes a spring loaded plunger and stopper to open. When open, fuel flows normally to the fuel pump. When closed due to the power being interrupted perhaps from a low oil pressure sensor for example, it shuts off fuel supply and causes the engine stop running. The fuel pump gets no fuel to pump to the fuel injector. Most failures are a result of debris in the fuel or varnish build up that cause the plunger inside to stick and either not open fully or stick. When this happens and the engine is running what you notice is black smoke and erratic engine speeds. When it fails it may also cause your engine to shut off for no apparent reason.

When this switch is sticking the result is often black smoke from the exhaust and erratic engine speeds.

A quick cure for this problem is to simply unscrew this part and remove the spring and plunger. Start engine again and see if it runs normally. Often you can just reassemble it and it will work again. When the plunger is removed, you can only shut off the engine by releasing the run/stop lever. The key switch or remote will make no difference.

Note that poor fuel quality can damage the rubber fuel lines and this switch causing components to stick.

Hooking Up To Your Home

A manual transfer switch is the key to safe and convenient operation of portable generators for standby power. By isolating those circuits using generator power, a transfer switch eliminates the risk of back feeding the electrical utility, which can cause injury to workers and property damage. By installing a transfer switch at your breaker box and connecting a portable generator to the transfer switch, you can run selected circuits for appliances such as a furnace, well pump sump pump, refrigerator, television, computer, printer or lighting circuit during a power outage, depending on the capacity of your generator. Since many portable generators cannot handle all of these loads at the same time, the transfer switch allows you to manually transfer each of these loads separately whenever you need them.

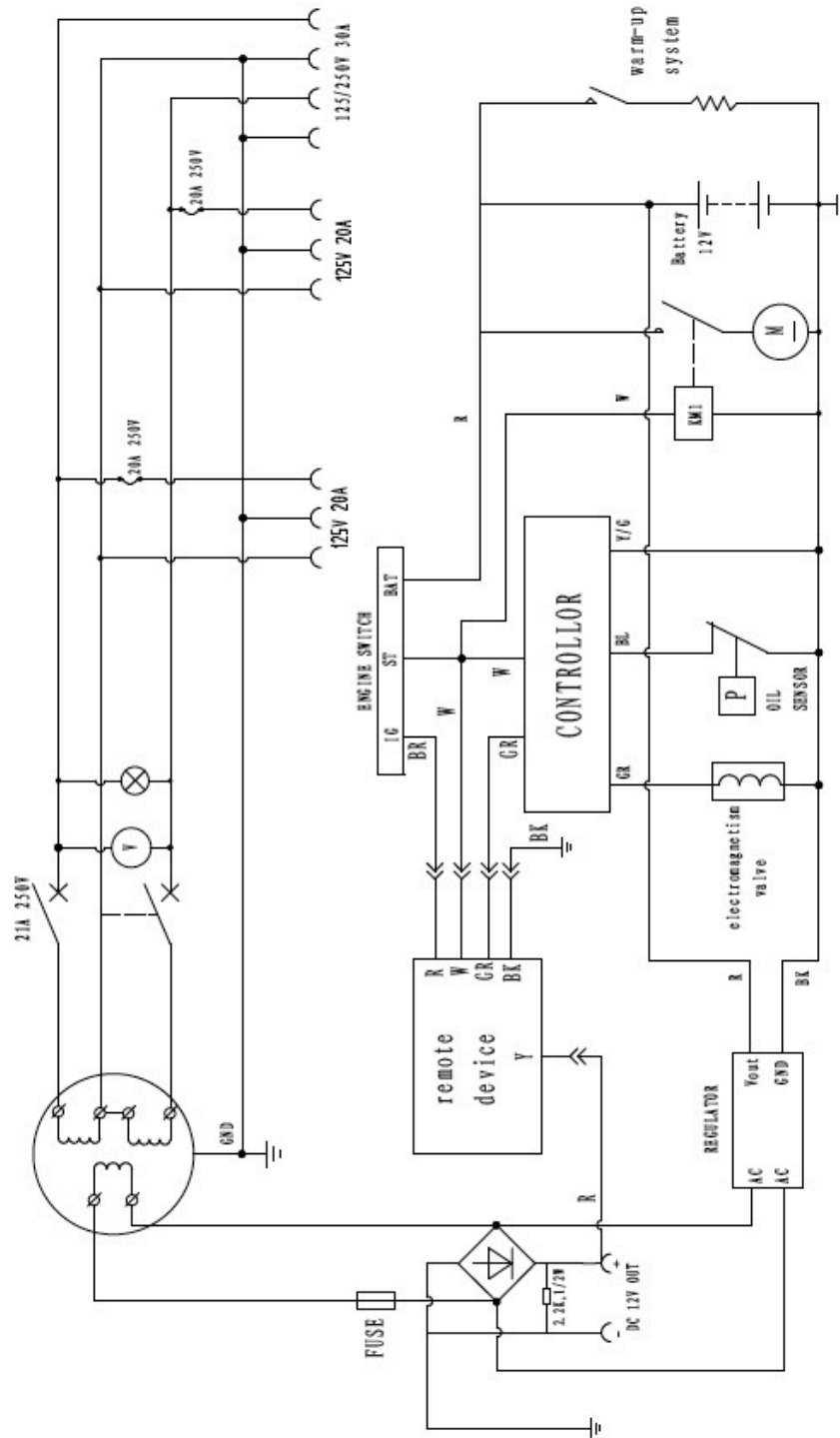
Determining which circuits you will require during a power outage is the first step in selecting the proper wattage generator and transfer switch. Since most home appliances operate intermittently, a 3000 watt generator can provide adequate power to circuits for the most common appliances, such as furnace, lights, refrigerator, freezer, microwave oven, and TV. If your home has a deep well pump with up to 1 HP motor, a 5000 watt generator will be required to provide the starting capacity for the pump.

Larger wattage units can be selected for simultaneous starting and operation of multiple appliances. We carry a huge selection of transfer switches, electrical cables, plugs and outlet boxes. See what we have to offer that will help make your installation one that will get the job done right.

Parts & Service

Aurora carries a huge selection of parts. Shop online at www.AuroraGenerators.com or call us at 1-877-510-6807

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